Moving Manufacturing to the Left With Immersion Technology ESI IC.IDO

A presentation of IC.IDO, leading decision-making platform based on virtual reality

Tony Davenport
Manager, Aerospace & Defense
ESI North America
NSRP 2015
Global Foot print with 30 offices world-wide
6 offices in 5 states
North America Headquarters in Farmington Hills, MI
150+ people
- R&D
- Engineering Services
- Onsite contractors
- Sales and marketing
Virtual Product Engineering

Manufacturing and Assembly
- multiphysics
- casting
- sheet metal forming
- composites
- welding & assembly
- NVH & dynamics

Virtual Environment
- virtual integration platform
- electromagnetic
- fluid dynamics
- vibro-acoustics
- crash, impact & safety
- biomechanics
- comfort

Virtual Performance
- virtual reality

COLLABORATE
- systems modeling

CONTROL
- moving manufacturing to the left

get it right

www.esi-group.com
Global Customer References
Academic Partners
200 +

Massachusetts Institute of Technology

Iowa State University

THE UNIVERSITY OF ALABAMA

Virginia Tech

The University of Akron

Penn State

École Polytechnique Montréal

Kangwon National University

Daegu University

Beijing Institute

Beihang University
Moving Manufacturing to the Left

10 Years of Research

Over 10 Years of Industrialization

We drive innovation in collaboration: over 100 customers worldwide

IC.IDO development strategy
- Based on over 20 years of successful development of VR solutions in highly demanding industries (Automotive, Aerospace, Defense, etc.)
- Driven by industrial pain points, needs, preoccupation

Supported by senior consultants with many years of technology and process know-how
What is IC.IDO?

IC.IDO is the leading virtual reality based collaborative decision-making solution
IC.IDO – Immersion Technology
IC.IDO makes up for missing physical prototypes
Reduction of costly physical mockups and prototypes

Virtual prototypes enable frontloading
Earlier understanding, validation, tryout

IC.IDO optimizes and fosters collaboration worldwide
Engaging decision-making processes

Hands-On interactive Solution
Personal comprehension of the product
Better understanding = Better decisions
Nothing gets you closer to reality

Tracked, Real-time and 1:1 Scale Visualization

Fill the gap between theory and reality

Realistic and Intuitive Interaction

Test concepts or processes

Realistic and Real-time Product Behaviour

Enhance product development processes

Collaborative Working In Teams

Make the right decision
Enable collaboration at all levels

IC.IDO helps you to handle

- **Multi Discipline** Decision Process (Design – Engineering – Manufacturing – Production – Service)
- **Multi Layer** Decision Processes (“top down/bottom up”)
- **Multi Sites** decision process (Design, Production, Supplier, Component, System)

![Diagram showing various departments and decision processes](image-url)
Interactive Elastic Simulation
Optimize and Validate Assembly & Service Processes
Wires, Pipes, Harnesses
Cable, hoses, wires are almost everywhere.

Unfortunately, they are many times the last items to be considered.
How to solve with Digital Mock Up (DMU)?

Challenge

- Mega-Trend: increasing complexity
- More and more cables, wire harnesses, several branches, varying cross-sections etc.
- Difficult to manage environmental dependencies

Source: DELPHI
Challenge

How to solve with DMU?

• Assembly & service processes with cables mostly require human interaction
• How to plan, optimize and validate manual work, ergonomics, accessibility
Challenge

How to solve with DMU?

- Cables and routing is sketched and planned in CAD
- Idealized routing ≠ later real routing
- How to determine the optimal length, critical bending, contact situation in operation mode etc.

CATIA V6 | Electrical Engineering & Wire Harness Design
Limitation of DMU tools

"The DMU is a fantastic tool, but the lesson learned from the A380 was that we needed to go further to anticipate system installation problems.

This was a large burden we carried on the A380 programme and this is why we've built this physical mock-up."

On the A380, Airbus relied solely on digital mock-up software to test the installation of wiring and other systems, which it found to its cost was inadequate at replicating the reality of the actual assembly effort. The airframer was forced to redesign and reinstall wiring looms and re-invent its assembly process, leading to the major production delays suffered by the programme. [http://www.flightglobal.com/](http://www.flightglobal.com/)
Solution Concept (Generic)

Objective

Manage increasing complexity

Overcome inherent limitations of DMU

.. meet the high demands of Manufacturing Engineers, Service & Maintenance Engineers and Integration Engineers
Objective

Solution Concept (Generic)

.. meet the high demands of Manufacturing Engineers, Service & Maintenance Engineers and Integration Engineers

- Physics
- Real-Time
- Natural Interaction
- Immersive Visualization
Solution Concept

Overview

- Physics
- Real-Time
- Immersive Visualization
- Natural Interaction

Moving Manufacturing to the Left
“as close to reality as possible”

**Advantage**
- Experience the real cable behavior
  - bending, torsion, gravity -
- Even when it gets complex
  - branch, pre-formed hoses, attached cable clips etc. -

**Added Value**
- Reduce engineering change requests
- Validate the design intention, very early in the process
“as close to reality as possible”

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Real-Time better than Offline

Faster and more reliably
Real-Time better than Offline

Faster and more reliably

**Advantage**
- Straightforward, grab the part and move it!
- Close to real assembly / service process
- **Real** collision handling instead of collision detections, then … stop! “What’s next?”

**Added Value**
- Up to 6 times faster than “classical” CAD / DMU process
Get a realistic impression

Advantage

- Experience the process in live size
- Listen to your intuition regarding critical distances, cable handling, workspace ...

Added Value

- Save time and money by reducing the number of physical mockups
Powerwalls & Caves

- Power wall installation at Daimler
- Multi-wall CAVE installation at Ford
- Three wall CAVE installation illustration
- Four wall CAVE installation
How does IC.IDO work?

IC.IDO's Software + Projection Hardware + People (Stakeholders) = Faster Decision, Improved Quality, Faster ROI
### Scalable Virtual Reality Workplace

| Easy to integrate in existing processes connecting to numerous CAE and PLM systems | Simple, robust and standardized solution | Compatible with nearly every 3D hardware | Efficient visualization and simulation from small desktop 3D installation to high-end multi wall installations (CAVE) |

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![Virtual Reality Hardware](image1.png)

![Virtual Reality Simulation](image2.png)
Overview Software Portfolio
IC.IDO Modules

**IDO.EXPLORE**
- Immersive and desktop exploration
- Basic DMU feature set
- Support for numerous VR hardware
- Data/Process Integration

**IDO.SOLIDMECHANICS**
- 100% penetration free rigid body simulation
- High performance for immersive assembly simulation

**IDO.ELASTIC**
- Unique physically correct elastic part simulation
- Dynamic validation of tubes, harnesses and full cable branches

**IDO.ERGONOMICS**
- Interactive ergonomic analysis
- Reachability, visibility, comfort

**IDO.ILLUMINATE**
- Create realistic 3D-environments and product in its natural environment
- Validate lighting conditions and visual appearance of your product

**IDO.PRESENT**
- Orchestrate your presentation
- Communicate complex dynamic behaviors

**IDO.COOPERATE**
- Real-time immersive collaboration
- Independent from HW setup
**Case Study Virtual Engineering**

**Power Generation Industry**

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**Challenges**
- Assembly verification and maintenance and studies
- Collaboration and communication with suppliers

**Solution**
- Early verification on manufacturing and maintenance processes
- Long-distance collaboration for multi-sites reviews

**Benefits**
- Significant diminution of errors
- Optimized product regarding assembly and service

**System Used**
- IDO:Explore; IDO:Package; IDO:Cooperate
- Powerwall

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“For illustration purposes only

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“*The value of the IC.IDO Solution was already visible in the early test-phase*”

Michael Schwarzlose, Teamleader: Siemens / Energy Sector Fossil Power Generation; Berlin

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**Challenges**
- Organize complex assembling situations
- Assembly orders to be validated by different departments, with different views and knowledge

**Solution**
- Interactive assembling simulation
- Virtual try-out with IC.IDO (no physical prototype)
- Easy determination, modification and documentation of assembly processes

**Benefits**
- Save iterations of development
- Design to build
- Early design verification

**System Used**
- IDO:Explore, Package, Ergonomics, MultiInteract
- 3 IC:ROAD Mobile Systems
Future Use Case

Scientific Visualization

- **Integrate** engineering simulation results into existing Virtual Reality engineering workflows and established processes
- **Build** a platform solution for interactive CAE exploration, processing and result documentation
- **Provide** an integrated intuitive immersive user experience for all steps of the product engineering process – in a single, immersive tool
IC.IDO CAE/CFD demonstrator

- Integration of flow and geometry in a 3D model of the whole plant area
- CFD post processing
  - Stream tracer
  - Streamlines
  - Scalar fields
  - Vector fields
  - Wall pressure
- Interactive immersion into the flow field
- Visualization of critical physical effects, e.g., residual swirl at turbine outflow

Use cases
- Representation
- Information
- Review
- Training
- Preparation of plant visits

Voith Hydro, D- Heidenheim
We could go off and build a solution in ~1 year, but would it match what you want?

What would be a 5-10 Year Vision of how the shop floor could utilize weld sequencing optimization?

What would you all like to see in that Vision?

How would it blend into your current workflow?

Possible Future: Microsoft’s Halo Lens Combined With ESI’s IC.IDO Platform For Engineering & Shop Floor (Welding, Cabling, Wiring) Collaboration
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